

# BEST AVAILABLE COPY

## PATENT ABSTRACTS OF JAPAN

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(71)Applicant : EBARA CORP

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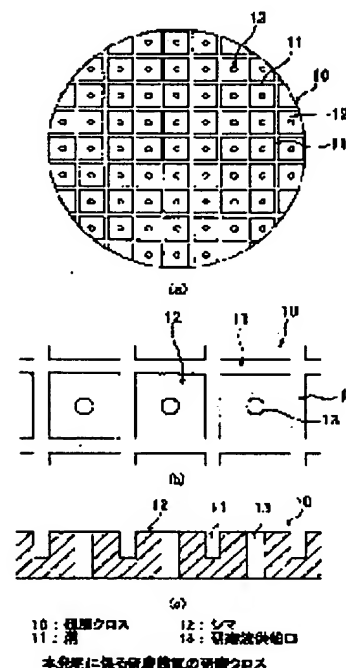
(72)Inventor : NABEYA OSAMU

**(54) POLISHING EQUIPMENT**

(57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a polishing equipment in which a top ring does not vibrate during polishing operation of a substrate and the quantity of polishing liquid being used can be reduced significantly.

**SOLUTION:** The equipment for pressing the face of a substrate being polished against the polishing face of a polishing table and polishing the face of the substrate being polished through relative motion thereof while supplying polishing liquid to the polishing face is provided with a polishing liquid supply opening 13 opening to the polishing face of the polishing table (upper surface of a polishing cloth 10), a plurality of grooves 11 made in the polishing face not to communicate directly with the polishing liquid supply opening 13, and means for supplying polishing liquid to the polishing face through the polishing liquid supply opening 13.

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**CLAIMS**

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**[Claim(s)]**

[Claim 1] In the polish equipment which presses the polished surface-ed of a substrate to the polished surface of a polish table, supplies polish liquid to this polished surface, and grinds the polished surface-ed of a substrate by the relative movement of the polished surface-ed of this substrate, and the polished surface of said polish table Polish equipment characterized by having established two or more slots which are not directly open for free passage to this polish liquid feed hopper in this polished surface, and establishing a polish liquid supply means to supply polish liquid to said polished surface through this polish liquid feed hopper while preparing the polish liquid feed hopper which carries out opening in the polished surface of said polish table.

[Claim 2] In the polish equipment which presses the polished surface-ed of a substrate to the polished surface of a polish table, supplies polish liquid to this polished surface, and grinds the polished surface-ed of a substrate by the relative movement of the polished surface-ed of this substrate, and the polished surface of said polish table Polish equipment characterized by establishing a polish liquid supply means to supply polish liquid to said polished surface through this polish liquid feed hopper while preparing one or more concave heights in said polished surface and preparing the polish liquid feed hopper which carries out opening to at least one or more heights of these concave heights.

[Claim 3] It is polish equipment characterized by for the supply of said polish liquid to the polished surface of said polish table letting said polish liquid feed hopper pass in polish equipment according to claim 1 or 2, and carrying out by the differential pressure produced by the relative motion of the polished surface of this polish table, and the polished surface-ed of said substrate.

[Claim 4] Polish equipment characterized by discharging the polish liquid after scouring which flowed into said slot in polish equipment according to claim 1 or 2.

[Claim 5] In the polish equipment which presses the polished surface-ed of a substrate to the polished surface of a polish table, supplies polish liquid to this polished surface, and grinds the polished surface-ed of a substrate by the relative movement of the polished surface-ed of this substrate, and the polished surface of said polish table While preparing the polish liquid feed hopper which carries out opening in the polished surface of said polish table and preparing the polish liquid supply tub which stores the polish liquid supplied to this polished surface lower part through a polish liquid supply line It is polish equipment which prepares the polish liquid discharge tub which is open for free passage to this polish liquid supply tub, prepares polish liquid discharge Rhine which is open for free passage to this polish liquid discharge tub, and is characterized by making said polish liquid gush from said polished surface lower part through said polish liquid feed hopper.

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]****[0001]**

**[Field of the Invention]** This invention presses the polished surface-ed of substrates, such as a semi-conductor wafer, to the polished surface of a polish table, and relates to the polish equipment which grinds the polished surface-ed of a substrate by the relative motion of a substrate and a polish table.

**[0002]**

**[Description of the Prior Art]** The former and this kind of polish equipment has composition which grinds the polished surface-ed of a substrate by the relative motion of the polished surface-ed of a substrate, and the polished surface of a polish table, providing the polish table which stuck the polish cross used as a polished surface on the top face, and the top ring holding a substrate, pressing the polished surface-ed of the substrate held by this top ring to the polished surface of a polish table, and supplying polish liquid to this polished surface.

**[0003]** Otherwise, the improvement on various functions is demanded of the polish equipment which grinds the polished surface-ed of a semi-conductor wafer with improvement in the degree of integration of a semiconductor device not to mention the polish engine performance (effectiveness of polish, homogeneity of polish, etc.). In the polish equipment of such a configuration, there is a problem that a top ring vibrates during polish. Vibration of this top ring emitted the noise, gave vibration to each part of polish equipment, and it not only injures work environment, but it had the problem of having a bad influence on that engine performance.

**[0004]** Moreover, in the polish equipment of the above-mentioned configuration, the slurry was used for polish liquid and the supply flow rate of this slurry also usually had the problem that as 200 ml/min and this raised the running cost of substrate polish.

**[0005]**

**[Problem(s) to be Solved by the Invention]** It aims at offering the polish equipment which this invention was made in view of the above-mentioned point, and there is no vibration of a top ring during polish of a substrate, and can reduce the amount of the polish liquid used sharply.

**[0006]**

**[Means for Solving the Problem]** In order to solve the above-mentioned technical problem invention according to claim 1 In the polish equipment which presses the polished surface-ed of a substrate to the polished surface of a polish table, supplies polish liquid to this polished surface, and grinds the polished surface-ed of a substrate by the relative movement of the polished surface-ed of this substrate, and the polished surface of a polish table While preparing the polish liquid feed hopper which carries out opening in the polished surface of a polish table, it is characterized by having established two or more slots which are not directly open for free passage to this polish liquid feed hopper in this polished surface, and establishing a polish liquid supply means to supply polish liquid to a polished surface through this polish liquid feed hopper.

**[0007]** The polish liquid feed hopper which carries out opening is prepared in the polished surface of a polish table as mentioned above. With a polish liquid supply means By supplying polish liquid between the polished surface-ed of a substrate, and the polished surface of a polish table through a polish liquid feed hopper Since polish liquid permeates and the film of uniform polish liquid is formed between these polished surfaces-ed The frictional force of this polished surface-ed and a polished surface can reduce sharply homogeneity or the amount of polish liquid flows which only the polish liquid of a flow rate required for polish will be supplied between these polished surfaces-ed, and is consumed at the same time it decreases and vibration of a top ring is prevented.

[0008] In the polish equipment which invention according to claim 2 presses the polished surface-ed of a substrate to the polished surface of a polish table, supplies polish liquid to this polished surface, and grinds the polished surface-ed of a substrate by the relative movement of the polished surface-ed of this substrate, and the polished surface of said polish table While preparing one or more concave heights in a polished surface and preparing the polish liquid feed hopper which carries out opening to at least one or more heights of these concave heights, it is characterized by establishing a polish liquid supply means to supply polish liquid to a polished surface through this polish liquid feed hopper.

[0009] In invention according to claim 2, by supplying polish liquid to a polished surface as mentioned above through the polish liquid feed hopper prepared in the heights of a polished surface, polish liquid and polish waste with which scouring was presented will flow into the crevice of a heights periphery promptly, and polish will be performed by always fresh polish liquid.

[0010] Invention according to claim 3 is characterized by for the supply of polish liquid to the polished surface of a polish table letting a polish liquid feed hopper pass, and performing it by the differential pressure produced by the relative motion of the polished surface of this polish table, and the polished surface-ed of said substrate in polish equipment according to claim 1 or 2.

[0011] As mentioned above, since polish liquid is supplied from a polish liquid feed hopper by the differential pressure produced by the relative motion of the polished surface of a polish table, and the polished surface-ed of a substrate, the polish liquid which is required for polish will be supplied, and the consumption of polish liquid can be reduced sharply.

[0012] Invention according to claim 4 is characterized by discharging the polish liquid after scouring which flowed into the slot in polish equipment according to claim 1 or 2.

[0013] By discharging the polish liquid after scouring which flowed into the slot as mentioned above, polish liquid and shaving waste after scouring are full of the polished surface of a polish table, and do not have a bad influence on polish of the polished surface-ed of a substrate.

[0014] In the polish equipment which invention according to claim 5 presses the polished surface-ed of a substrate to the polished surface of a polish table, supplies polish liquid to this polished surface, and grinds the polished surface-ed of a substrate by the relative movement of the polished surface-ed of this substrate, and the polished surface of a polish table While preparing the polish liquid feed hopper which carries out opening in the polished surface of a polish table and preparing the polish liquid supply tub which stores the polish liquid supplied to this polished surface lower part through a polish liquid supply line The polish liquid discharge tub which is open for free passage to this polish liquid supply tub is prepared, polish liquid discharge Rhine which is open for free passage to this polish liquid discharge tub is prepared, and it is characterized by making polish liquid gush from the polished surface lower part through a polish liquid feed hopper.

[0015] Since the polish liquid discharge tub which is open for free passage to a polish liquid supply tub as mentioned above was prepared and polish liquid discharge Rhine which is open for free passage to this polish liquid discharge tub was prepared It can permute promptly, without making polish liquid and pure water which are permuted by bringing together the polish liquid or pure water of a polish liquid supply tub in a polish liquid discharge tub, and discharging through polish liquid discharge Rhine mix the pure water or polish liquid in a polish liquid supply tub, when permuting the inside of a polish liquid supply tub by another polish liquid or pure water.

[0016]

[Embodiment of the Invention] Hereafter, the example of a gestalt of operation of this invention is explained based on a drawing. Drawing 1 (a) is the top view of a polish cross stuck on the polish table top face of the polish equipment concerning this invention, drawing 1 (b) is an enlarged drawing and drawing 1 (c) is a sectional view in part. The polish cross 10 used as a polished surface is stuck on the top face of a polish table, and the polish liquid feed hopper 13 which carries out opening is formed in the top face (polished surface) at the central part of the sima 12 which the slot 11 which intersects perpendicularly mutually was formed in the top face of this polish cross 10, and was surrounded by the slot 11 which this intersects perpendicularly.

[0017] Drawing 2 is the sectional view showing the outline configuration of the polish equipment concerning this invention. Polish equipment 20 possesses the polish table 21, and the above-mentioned polish cross 10 is stuck on the top face of this polish table 21. The polish liquid flow through-hole 23 of a large number which the polish liquid supply tub 22 by which polish liquid flows into the polish table 21 is formed, and carry out opening to the top face of this polish table 21 on this top face, and are open for free passage to the polish liquid supply tub 22 is formed, and it is open for free passage in this polish liquid flow

through-hole 23 to the polish liquid feed hopper 13 prepared in the above-mentioned polish cross 10.

[0018] The polish liquid supply pipe 26 is connected and, as for the polish liquid supply tub 22 of the above-mentioned polish table 21, the slurry supply pipe 25 and the pure-water supply pipe 24 are connected to this polish liquid supply pipe 26. It lets this slurry supply pipe 25 or the pure-water supply pipe 24 pass, and a slurry or pure water is supplied to the polish liquid supply tub 22, and fills this polish liquid supply tub 22. In the case of polish of a substrate, a slurry is supplied as polish liquid and, in the case of a water polish, pure water is supplied as polish liquid. Moreover, after polish termination fills the polish liquid supply tub 22 with pure water, and it is made not to affect the next polish by deterioration of a slurry.

[0019] The polish table 21 is supported by two or more eccentric revolving-shaft devices 27 and 28, and carries out eccentric movement horizontally with drives, such as a motor which is not illustrated. The polished surface-ed of the substrates W, such as a semi-conductor wafer held on the inferior surface of tongue of a top ring 29, is pressed by the top face of the polish cross 10 stuck on polish table 21 top face. Moreover, top ring 29 the very thing is rotating at the rate of predetermined in the direction of arrow-head A. By the differential pressure produced by the relative motion of the substrate W held at the polish cross 10 and top ring 29 of the polish table 21, the polish liquid in the polish liquid supply tub 22 passes along the polish liquid flow through-hole 23 of the polish table 21, and the polish liquid feed hopper 13 of the polish cross 10, permeates between the polished surface-ed of Substrate W, and polish cross 10 top face, and is contributed to polish of the polished surface-ed of Substrate W.

[0020] When the polish liquid feed hopper 13 is arranged in the slot 11 of the polish cross 10, by 200 ml/min, a top ring 29 vibrates [ a polish liquid (slurry) flow rate ] violently. If the amount of polish liquid flows is increased, vibration can be controlled, but since polish liquid pushes up a substrate and lowers planar pressure with the polish cross 10, a polish rate falls.

[0021] When the polish liquid feed hopper 13 has been arranged in the center section of the sima 12 of the polish cross 10, a big vibration is not generated in the amount of polish liquid flows of 50 ml/min, but the required polish rate is obtained. In this case, even if it raises the amount of polish liquid flows to 100 ml/min, change of a polish rate is slight. From these things, arrangement of this polish liquid feed hopper 13 enables saving of vibration isolation and polish liquid efficiently. In addition, drawing 3 is drawing showing the experimental result at the time of grinding a substrate with the polish equipment concerning this invention.

[0022] Moreover, about the flow rate of a slurry, since the rise of a polish rate (P/R) is 3% as for twice, a flow rate can be judged that 50 ml/min is enough as a slurry flow rate. With the polish equipment of the type which supplies a slurry to the top face of a polish table, since the amount of supply of a slurry is usually 200 ml/min, it becomes possible [ reducing slurry volume sharply ] in this polish equipment. In addition, the polish liquid which flowed in after scouring in the slot is promptly discharged with the wastewater means which is not illustrated. Thereby, polish liquid and shaving waste after scouring are full of the polished surface of a polish table, and do not have a bad influence on polish of the polished surface-ed of a substrate.

[0023] In addition, although the polish liquid feed hopper 13 was formed in the center section of the sima 12 of the shape of a rectangle which formed the slot 11 of a large number which intersect perpendicularly with the top face of the polish cross 10, and was surrounded in this slot 11 in the above-mentioned example The slot formed in a polish cross top face is not what is limited to the slot which intersects perpendicularly. As shown in drawing 4, a slot 14 may be formed in the top face of the polish cross 10 concentric circular, the slot 15 of the radial which opens this slot 14 for free passage may be formed, and the polish liquid feed hopper 13 may be formed in the sima 12 surrounded in this concentric circular slot 14 and the slot 15 on the radial. moreover -- each -- the polish liquid feed hopper 13 formed in sima 12 is not limited to one piece, either, and is shown in drawing 5 -- as -- each -- more than one may be prepared according to the area of sima 12.

[0024] Moreover, although the above-mentioned example explained to the example the polish equipment in which the polish table 21 carries out eccentric movement horizontally and which a top ring 29 rotates, and illustration is omitted, a polish table and a top ring may rotate on a horizontal plane. Furthermore, the polish table 21 has the shape of the shape of a belt, and a sheet, and it can also consider as the configuration which has the same abrasive liquid supply means and an abrasive liquid leakage prevention device to a belt or a sheet. This invention is applicable if it is polish equipment which, in short, grinds the polished surface-ed of a substrate by the relative movement of the polished surface-ed of a substrate, and the polished surface of said polish table.

[0025] In order to make polish liquid gush to homogeneity on the top face (polished surface) of the polish cross 10, the polish liquid supply tub 22 which the polish liquid flow through-hole 23 and the polish liquid

feed hopper 13 open for free passage in the polished surface lower part of the polish table 21 is formed, and polish liquid is made to gush in the form where this polish liquid supply tub 22 is overflowed, in the polish equipment of a configuration of being shown in drawing 2 . By this approach, since polish liquid will be collected to the polish liquid supply tub 22, in case it permutes by another polish liquid and pure water, all polish liquid collected on this polish liquid supply tub 22 must be poured on the top face of the polish cross 10, i.e., a polished surface, and, moreover, there is a problem that a permutation rate is slow. The configuration of the polish equipment developed in order to solve the problem that the permutation rate of this polish liquid is slow is shown in drawing 6 thru/or drawing 8 . The B-B sectional view of drawing 6 and drawing 8 of the sectional view in which drawing 6 shows the outline configuration of this polish equipment, and drawing 7 are the C-C sectional views of drawing 6 .

[0026] As shown in drawing 6 thru/or drawing 8 , this polish equipment formed the polish liquid supply tub 22 by which polish liquid flows into the polish table 21, opened for free passage and formed the slot [ two or more (drawing five pieces) ] 30 in the periphery section of this polish liquid supply tub 22 at this polish liquid supply tub 22, and has prepared further the polish liquid discharge tub 31 of the polish liquid supply tub 22 which is open for free passage to this slot 30 caudad. Moreover, opening 26a which is open for free passage to the polish liquid supply pipe 26 was prepared in the center of a base of the polish liquid supply tub 22, and the openings 32a and 33a which are open for free passage to the polish liquid exhaust pipes 32 and 33 are formed in the base of the polish liquid discharge tub 31. The polish liquid feed hopper 13 and the polish liquid flow through-hole 23 of the polish cross 10 are open for free passage to the polish liquid supply tub 22 like drawing 2 . In addition, the polish liquid exhaust pipes 32 and 33 lead to factory drainage Rhine or polish liquid playback Rhine which is not illustrated through the closing motion valve (not shown).

[0027] In the polish equipment of a configuration of being shown in drawing 6 thru/or drawing 8 , pure water is filled by both the tubs of the polish liquid supply tub 22 and the polish liquid discharge tub 31, before grinding. When polish liquid permutes the polish liquid supply tub 22, the closing motion valve of the above-mentioned polish liquid exhaust pipes 32 and 33 is opened at first, and the pure water in the polish liquid supply tub 22 is discharged by self-weight using the difference of elevation with factory drainage Rhine (for example, about 3 seconds).

[0028] Next, polish liquid (slurry) is supplied to the polish liquid supply tub 22 through the polish liquid supply pipe 26 by the predetermined flow rate (for example, about 500 ml/min) as it is. Polish liquid turns to the polish liquid discharge tub 31, filling the polish liquid supply tub 22. Both tubs close the above-mentioned closing motion valve after the permutation initiation predetermined time filled with polish liquid (for example, after about 10 seconds). Furthermore, if predetermined time (for example, about 5 seconds) polish liquid is supplied, many the polish liquid feed hoppers 13 and the polish liquid flow through-holes 23 which are well-informed about the polished surface are also permuted by polish liquid, and will be in the condition which can be ground. When polish of Substrate W is completed and it permutes the polish liquid in the polish liquid supply tub 22 and the polish liquid discharge tub 31 by pure water, the above-mentioned procedure is shortly performed using pure water.

[0029] Since the polish liquid discharge tub 31 which is open for free passage to the polish liquid supply tub 22 through a slot 30 as mentioned above was formed and the polish liquid exhaust pipes 32 and 33 which are open for free passage to this polish liquid discharge tub 31 were formed When permuting the pure water of the polish liquid supply tub 22 by polish liquid before polish initiation and permuting by another polish liquid during polish, It can permute promptly, without making polish liquid and pure water which are permuted by bringing together the pure water or polish liquid of the polish liquid supply tub 22 in the polish liquid discharge tub 31, and discharging through the polish liquid exhaust pipes 32 and 33 mix pure water and polish liquid in the polish liquid supply tub 22, when permuting that it is pure after polish termination.

[0030]

[Effect of the Invention] As explained above, according to invention given in each claim, the following outstanding effectiveness is acquired.

[0031] According to invention according to claim 1, the polish liquid feed hopper which carries out opening is prepared in the polished surface of a polish table. With a polish liquid supply means By supplying polish liquid between the polished surface-ed of a substrate, and the polished surface of a polish table through a polish liquid feed hopper Since polish liquid permeates and the film of uniform polish liquid is formed between these polished surfaces-ed The frictional force of this polished surface-ed and a polished surface can reduce sharply homogeneity or the amount of polish liquid flows which only the polish liquid of a flow rate required for polish will be supplied between these polished surfaces-ed, and is consumed at the same time it decreases and vibration of a top ring is prevented.

[0032] According to invention according to claim 2, by supplying polish liquid to a polished surface through the polish liquid feed hopper prepared in the heights of a polished surface, polish liquid and polish waste with which scouring was presented will flow into the crevice of a heights periphery promptly, and polish will be performed by always fresh polish liquid.

[0033] Since polish liquid is supplied from a polish liquid feed hopper by the differential pressure produced by the relative motion of the polished surface of a polish table, and the polished surface-ed of a substrate according to invention according to claim 3, the polish liquid which is required for polish will be supplied, and the consumption of polish liquid can be reduced sharply.

[0034] According to invention according to claim 4, by discharging the polish liquid after scouring which flowed into the slot, polish liquid and shaving waste after scouring are full of the polished surface of a polish table, and do not have a bad influence on polish of the polished surface-ed of a substrate.

[0035] Since according to invention according to claim 5 the polish liquid discharge tub which is open for free passage to a polish liquid supply tub was prepared and polish liquid discharge Rhine which is open for free passage to this polish liquid discharge tub was prepared It can permute promptly, without making polish liquid and pure water which are permuted by bringing together the polish liquid or pure water of a polish liquid supply tub in a polish liquid discharge tub, and discharging through polish liquid discharge Rhine mix the pure water or polish liquid in a polish liquid supply tub, when permuting the inside of a polish liquid supply tub by another polish liquid or pure water.

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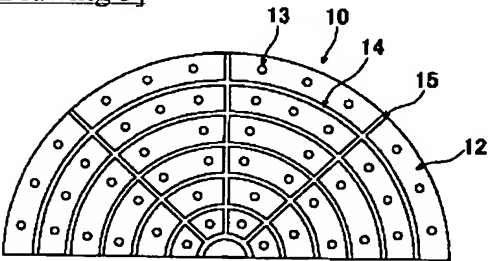
DRAWINGS

[Drawing 3]

スラリー流量 (実測)	基板の径方向を所定のピッチで測定			基板の周方向を所定のピッチで測定			とびり発生
	P/R(mm/min.)	Uni.(1σ) (%)	Uni.(M-m) (%)	P/R(mm/min.)	Uni.(1σ) (%)	Uni.(M-m) (%)	
40(ml/min.)	55.5	8.0	23.0	47.3	22.0	31.7	微
50(ml/min.)	56.0	9.3	25.3	46.1	24.1	31.6	なし
75(ml/min.)	55.6	10.9	26.2	46.4	23.5	32.5	なし
100(ml/min.)	57.4	8.7	24.9	47.5	22.9	31.5	なし

本発明に係る研磨装置で基板を研磨した場合の実験結果

[Drawing 5]

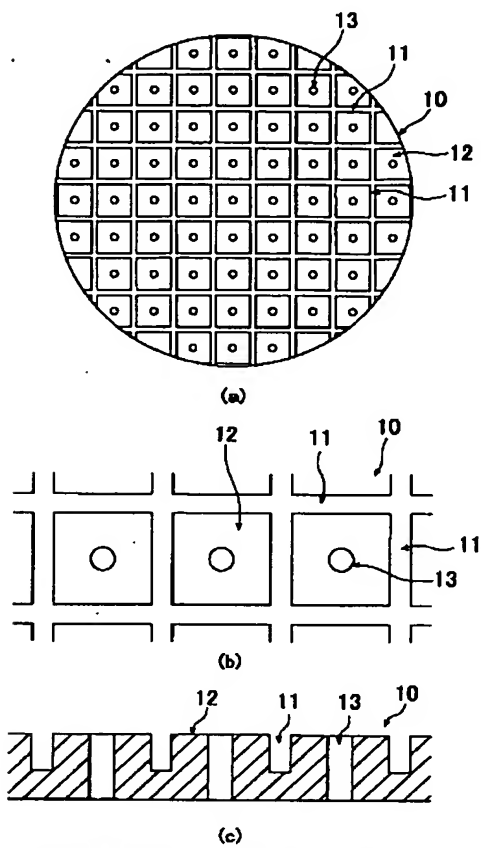


- 10 : 研磨クロス
- 12 : シマ
- 13 : 研磨液供給口
- 14 : 溝
- 15 : 溝

本発明に係る研磨装置の研磨クロスを示す一部平面図

[Drawing 1]

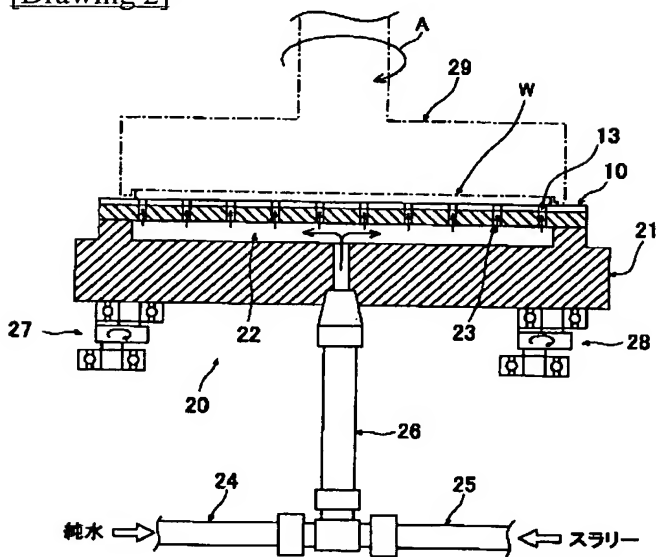




10 : 研磨クロス      12 : シマ  
11 : 溝              13 : 研磨液供給口

本発明に係る研磨装置の研磨クロス

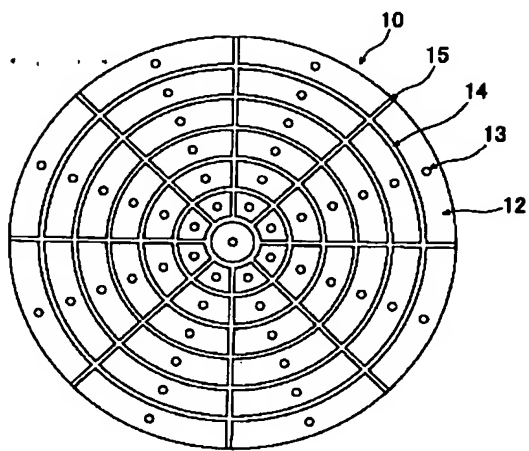
[Drawing 2]



10 : 研磨クロス      24 : 純水供給管      W : 基板  
13 : 研磨液供給口      25 : スラリー供給管  
20 : 研磨装置      26 : 研磨液供給管  
21 : 研磨テーブル      27 : 偏心回転軸機構  
22 : 研磨液供給槽      28 : 偏心回転軸機構  
23 : 研磨液流通孔      29 : トップリング

本発明に係る研磨装置の概略構成を示す断面図

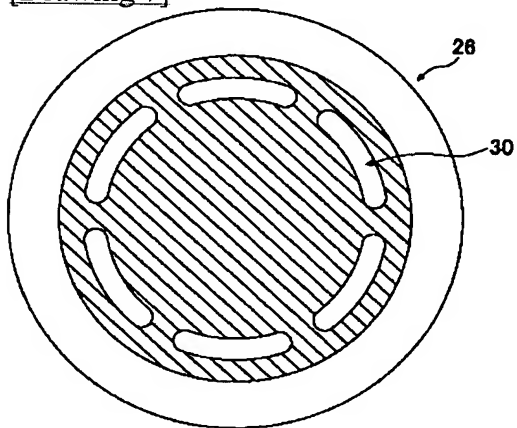
[Drawing 4]



10 : 研磨クロス  
 12 : シマ  
 13 : 研磨液供給口  
 14 : 溝  
 15 : 溝

本発明に係る研磨装置の研磨クロスを示す平面図

[Drawing 7]



26 : 研磨液供給管  
 30 : 長穴

図6のB-B断面図

[Drawing 6]

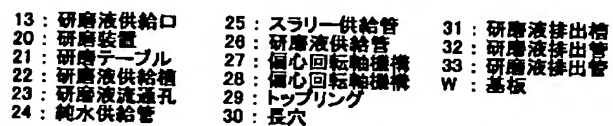


Figure 6 is a cross-sectional view of a circular structure 21. The structure 21 has a central opening 31. Within this opening, there is a central circular element 26a, which is surrounded by a cross-hatch pattern. To the left and right of element 26a are two smaller circular elements, 32a and 33a, respectively. The entire assembly is shown in a cross-sectional view, with the outer ring 21 having a hatched pattern.

**図6のC-C断面図**

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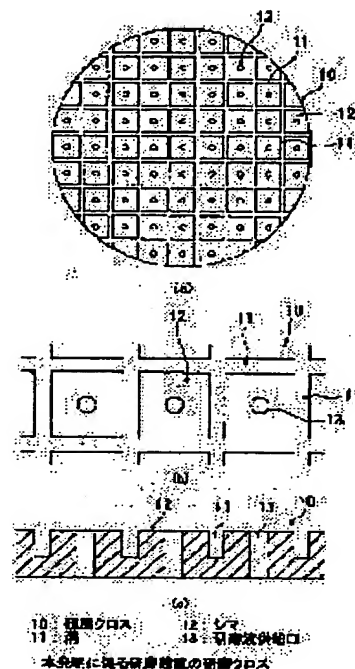
(72)Inventor : NABEYA OSAMU

## (54) POLISHING EQUIPMENT

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a polishing equipment in which a top ring does not vibrate during polishing operation of a substrate and the quantity of polishing liquid being used can be reduced significantly.

**SOLUTION:** The equipment for pressing the face of a substrate being polished against the polishing face of a polishing table and polishing the face of the substrate being polished through relative motion thereof while supplying polishing liquid to the polishing face is provided with a polishing liquid supply opening 13 opening to the polishing face of the polishing table (upper surface of a polishing cloth 10), a plurality of grooves 11 made in the polishing face not to communicate directly with the polishing liquid supply opening 13, and means for supplying polishing liquid to the polishing face through the polishing liquid supply opening 13.



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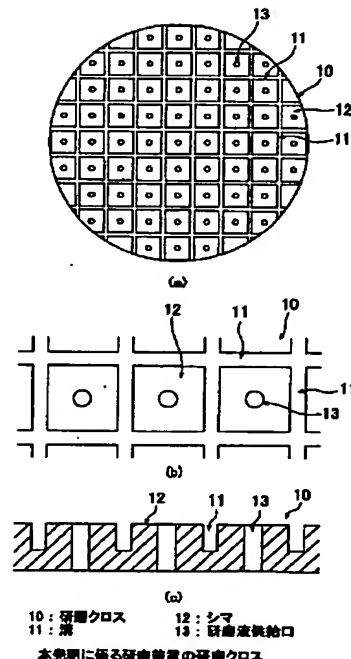
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(54) 【発明の名称】 研磨装置

(57) 【要約】

【課題】 基板の研磨中にトップリングの振動が無く、且つ研磨液の使用量を大幅に削減できる研磨装置を提供すること。

【解決手段】 基板の被研磨面を研磨テーブルの研磨面に押圧し、研磨液を該研磨面に供給し、該基板の被研磨面と研磨テーブルの研磨面の相対的運動により基板の被研磨面を研磨する研磨装置において、研磨テーブルの研磨面(研磨クロス10の上面)に開口する研磨液供給口13を設けると共に、該研磨面に該研磨液供給口13に直接連通しない複数の溝11を設け、該研磨液供給口13を通して研磨面に研磨液を供給する研磨液供給手段を設けた。



## 【特許請求の範囲】

【請求項1】 基板の被研磨面を研磨テーブルの研磨面に押圧し、研磨液を該研磨面に供給し、該基板の被研磨面と前記研磨テーブルの研磨面の相対的運動により基板の被研磨面を研磨する研磨装置において、前記研磨テーブルの研磨面に開口する研磨液供給口を設けると共に、該研磨面に該研磨液供給口に直接連通しない複数の溝を設け、該研磨液供給口を通して前記研磨面に研磨液を供給する研磨液供給手段を設けたことを特徴とする研磨装置。

【請求項2】 基板の被研磨面を研磨テーブルの研磨面に押圧し、研磨液を該研磨面に供給し、該基板の被研磨面と前記研磨テーブルの研磨面の相対的運動により基板の被研磨面を研磨する研磨装置において、前記研磨面に1以上の凹凸部を設け、該凹凸部の少なくとも1以上の凸部に開口する研磨液供給口を設けるとともに、該研磨液供給口を通して前記研磨面に研磨液を供給する研磨液供給手段を設けたことを特徴とする研磨装置。

【請求項3】 請求項1又は2に記載の研磨装置において、前記研磨テーブルの研磨面への前記研磨液の供給は前記研磨液供給口を通して、該研磨テーブルの研磨面と前記基板の被研磨面の相対運動により生じる圧力差で行うことを特徴とする研磨装置。

【請求項4】 請求項1又は2に記載の研磨装置において、前記溝に流れ込んだ研磨作用後の研磨液を排出することを特徴とする研磨装置。

【請求項5】 基板の被研磨面を研磨テーブルの研磨面に押圧し、研磨液を該研磨面に供給し、該基板の被研磨面と前記研磨テーブルの研磨面の相対的運動により基板の被研磨面を研磨する研磨装置において、前記研磨テーブルの研磨面に開口する研磨液供給口を設け、該研磨面下部に研磨液供給ラインを通して供給される研磨液を貯留する研磨液供給槽を設けると共に、該研磨液供給槽に連通する研磨液排出槽を設け、該研磨液排出槽に連通する研磨液排出ラインを設け、前記研磨液は前記研磨液供給口を通して前記研磨面下部より湧出させることを特徴とする研磨装置。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は半導体ウエハ等の基板の被研磨面を研磨テーブルの研磨面に押圧し、基板と研磨テーブルの相対運動により基板の被研磨面を研磨する研磨装置に関するものである。

## 【0002】

【従来の技術】従来、この種の研磨装置は、上面に研磨面となる研磨クロスを貼り付けた研磨テーブルと、基板を保持するトップリングを具備し、該トップリングで保

持する基板の被研磨面を研磨テーブルの研磨面に押圧し、該研磨面に研磨液を供給しながら、基板の被研磨面と研磨テーブルの研磨面の相対運動により、基板の被研磨面を研磨する構成となっている。

【0003】半導体デバイスの集積度の向上に伴い、半導体ウエハの被研磨面を研磨する研磨装置には、その研磨性能（研磨の効率、研磨の均一性等）は勿論のこと、他にも種々の機能上の向上が要求されている。このような構成の研磨装置において、研磨中にトップリングが振動するという問題がある。このトップリングの振動は騒音を発し、作業環境を害するだけでなく、研磨装置の各部に振動を与え、その性能に悪影響を及ぼすという問題があった。

【0004】また、上記構成の研磨装置においては、研磨液にスラリーを使用しており、通常このスラリーの供給流量は200ml/minと多く、これが基板研磨のランニングコストを高めるといった問題もあった。

## 【0005】

【発明が解決しようとする課題】本発明は上述の点に鑑みてなされたもので、基板の研磨中にトップリングの振動が無く、且つ研磨液の使用量を大幅に削減できる研磨装置を提供することを目的とする。

## 【0006】

【課題を解決するための手段】上記課題を解決するため請求項1に記載の発明は、基板の被研磨面を研磨テーブルの研磨面に押圧し、研磨液を該研磨面に供給し、該基板の被研磨面と研磨テーブルの研磨面の相対的運動により基板の被研磨面を研磨する研磨装置において、研磨テーブルの研磨面に開口する研磨液供給口を設けると共に、該研磨面に該研磨液供給口に直接連通しない複数の溝を設け、該研磨液供給口を通して研磨面に研磨液を供給する研磨液供給手段を設けたことを特徴とする。

【0007】上記のように研磨テーブルの研磨面に開口する研磨液供給口を設け、研磨液供給手段により、研磨液供給口を通して基板の被研磨面と研磨テーブルの研磨面との間に研磨液を供給することにより、該被研磨面と研磨面の間に研磨液が浸透し均一な研磨液の膜が形成されるから、該被研磨面と研磨面の摩擦力が均一若しくは低減され、トップリングの振動が防止されると同時に、該被研磨面と研磨面の間に研磨に必要な流量の研磨液のみが供給されることになり消費される研磨液流量を大幅に削減できる。

【0008】請求項2に記載の発明は、基板の被研磨面を研磨テーブルの研磨面に押圧し、研磨液を該研磨面に供給し、該基板の被研磨面と前記研磨テーブルの研磨面の相対的運動により基板の被研磨面を研磨する研磨装置において、研磨面に1以上の凹凸部を設け、該凹凸部の少なくとも1以上の凸部に開口する研磨液供給口を設けるとともに、該研磨液供給口を通して研磨面に研磨液を供給する研磨液供給手段を設けたことを特徴とする。

【0009】請求項2に記載の発明では上記のように、研磨面の凸部に設けた研磨液供給口を通して研磨面に研磨液を供給することにより、研磨作用に供された研磨液や研磨屑は速やかに凸部外周の凹部に流れ込むことになり、常に新鮮な研磨液で研磨が行われることになる。

【0010】請求項3に記載の発明は、請求項1又は2に記載の研磨装置において、研磨テーブルの研磨面への研磨液の供給は研磨液供給口を通して、該研磨テーブルの研磨面と前記基板の被研磨面の相対運動により生じる圧力差で行うことを特徴とする。

【0011】上記のように、研磨テーブルの研磨面と基板の被研磨面の相対運動により生じる圧力差で研磨液供給口から研磨液を供給するので、研磨に必要なだけの研磨液が供給されることになり、研磨液の消費量を大幅に削減できる。

【0012】請求項4に記載の発明は、請求項1又は2に記載の研磨装置において、溝に流れ込んだ研磨作用後の研磨液を排出することを特徴とする。

【0013】上記のように溝に流れ込んだ研磨作用後の研磨液を排出することにより、研磨作用後の研磨液や削り屑が研磨テーブルの研磨面に溢れ、基板の被研磨面の研磨に悪影響を及ぼすことがない。

【0014】請求項5に記載の発明は、基板の被研磨面を研磨テーブルの研磨面に押圧し、研磨液を該研磨面に供給し、該基板の被研磨面と研磨テーブルの研磨面の相対運動により基板の被研磨面を研磨する研磨装置において、研磨テーブルの研磨面に開口する研磨液供給口を設け、該研磨面下部に研磨液供給ラインを通して供給される研磨液を貯留する研磨液供給槽を設けると共に、該研磨液供給槽に連通する研磨液排出槽を設け、該研磨液排出槽に連通する研磨液排出ラインを設け、研磨液は研磨液供給口を通して研磨面下部より湧出させることを特徴とする。

【0015】上記のように研磨液供給槽に連通する研磨液排出槽を設け、該研磨液排出槽に連通する研磨液排出ラインを設けたので、研磨液供給槽内を別の研磨液又は純水に置換する場合、研磨液供給槽の研磨液又は純水を研磨液排出槽に集め研磨液排出ラインを通して排出することにより、置換する研磨液や純水に研磨液供給槽内の純水又は研磨液を混合させることなく、速やかに置換できる。

【0016】

【発明の実施の形態】以下、本発明の実施の形態例を図面に基づいて説明する。図1(a)は本発明に係る研磨装置の研磨テーブル上面に貼り付ける研磨クロス10の平面図で、図1(b)は一部拡大図、図1(c)は一部断面図である。研磨テーブルの上面に研磨面となる研磨クロス10が貼り付けられており、該研磨クロス10の上面には互いに直交する溝11が形成され、該直交する溝11に囲まれたシマ12の中央部分に上面(研磨面)に開

口する研磨液供給口13が設けられている。

【0017】図2は本発明に係る研磨装置の概略構成を示す断面図である。研磨装置20は研磨テーブル21を具備し、該研磨テーブル21の上面には上記研磨クロス10が貼り付けられている。研磨テーブル21には研磨液が流入する研磨液供給槽22が設けられ、該研磨テーブル21の上面には該上面に開口し且つ研磨液供給槽22に連通する多数の研磨液流通孔23が設けられ、該研磨液流通孔23は上記研磨クロス10に設けられた研磨液供給口13に連通している。

【0018】上記研磨テーブル21の研磨液供給槽22は研磨液供給管26が接続されており、該研磨液供給管26にはスラリー供給管25及び純水供給管24が接続されている。該スラリー供給管25又は純水供給管24を通して、スラリー又は純水が研磨液供給槽22に供給され、該研磨液供給槽22を満たすようになっている。基板の研磨の際には、研磨液としてスラリーを供給し、水ポリッシュの場合は研磨液として純水を供給する。また、研磨終了後は研磨液供給槽22を純水で満たし、スラリーの変質による次の研磨に影響を与えないようにする。

【0019】研磨テーブル21は複数の偏心回転軸機構27、28で支持されており、図示しないモータ等の駆動機構により水平方向に偏心運動するようになっている。研磨テーブル21上面に貼り付けた研磨クロス10の上面にはトップリング29の下面に保持された半導体ウエハ等の基板Wの被研磨面が押圧されている。また、トップリング29自体は矢印A方向に所定の速度で回転している。研磨テーブル21の研磨クロス10とトップリング29に保持された基板Wの相対運動により生じる圧力差により、研磨液供給槽22内の研磨液は研磨テーブル21の研磨液流通孔23及び研磨クロス10の研磨液供給口13を通して、基板Wの被研磨面と研磨クロス10上面の間に浸透し、基板Wの被研磨面の研磨に寄与する。

【0020】研磨液供給口13が研磨クロス10の溝11に配置されていた場合、研磨液(スラリー)流量が200ml/minでは、トップリング29が激しく振動する。研磨液流量を増やせば振動は抑制できるが、研磨液が基板を押し上げ、研磨クロス10との面圧を下げるので研磨レートが低下する。

【0021】研磨液供給口13を研磨クロス10のシマ12の中央部に配置した場合、50ml/minの研磨液流量で大きな振動は発生せず、必要な研磨レートが得られている。この場合に研磨液流量を100ml/minに上げても研磨レートの変化が僅かである。これらのことから、この研磨液供給口13の配置は振動防止と研磨液の節約を効率的に可能にする。なお図3は本発明に係る研磨装置で基板を研磨した場合の実験結果を示す図である。

【0022】また、スラリーの流量に関しては流量を2倍にしても研磨レート(P/R)の上昇は3%であることから、スラリー流量は50ml/minで十分であると判断できる。研磨テーブルの上面にスラリーを供給するタイプの研磨装置では、スラリーの供給量は通常200ml/minであるから、本研磨装置ではスラリー量を大幅に減らすことが可能となる。なお、研磨作用後に溝に流れ込んだ研磨液は図示しない排水手段で速やかに排出する。これにより、研磨作用後の研磨液や削り屑が研磨テーブルの研磨面に溢れ、基板の被研磨面の研磨に悪影響を及ぼすことがない。

【0023】なお、上記例では研磨クロス10の上面に直交する多数の溝11を形成し、該溝11で囲まれた矩形状のシマ12の中央部に研磨液供給口13を設けたが、研磨クロス上面に形成する溝は直交する溝に限定されるものではなく、図4に示すように、研磨クロス10の上面に同心円状に溝14を形成し、該溝14を連通する放射状の溝15を設け、該同心円状の溝14と放射状の溝15で囲まれたシマ12に研磨液供給口13を設けてもよい。また、各シマ12に形成される研磨液供給口13も1個に限定されるものではなく、例えば図5に示すように各シマ12の面積に応じて複数個設けてもよい。

【0024】また、上記例では研磨テーブル21が水平方向に偏心運動し、トップリング29が回転運動する研磨装置を例に説明したが、図示は省略するが、研磨テーブルもトップリングも水平面上で回転するものであってもよい。更に研磨テーブル21がベルト状若しくはシート状であって、ベルト若しくはシートに対して同様の砥液供給手段と砥液漏れ防止機構を有する構成とすることもできる。要は基板の被研磨面と前記研磨テーブルの研磨面の相対的運動により基板の被研磨面を研磨する研磨装置であれば、本発明は適用できる。

【0025】図2に示す構成の研磨装置においては、研磨クロス10の上面(研磨面)に均一に研磨液を湧出させるため、研磨テーブル21の研磨面下部に研磨液流通孔23及び研磨液供給口13が連通する研磨液供給槽22を設け、該研磨液供給槽22を溢れる形で研磨液を湧出させている。この方法では、研磨液供給槽22に研磨液を貯めることになるため、別の研磨液や純水に置換する際にはこの研磨液供給槽22に貯まっている研磨液をすべて研磨クロス10の上面、即ち研磨面に流さなければならず、しかも置換速度が遅いという問題がある。この研磨液の置換速度が遅いという問題を解決するために開発した研磨装置の構成を図6乃至図8に示す。図6はこの研磨装置の概略構成を示す断面図、図7は図6のB-B断面図、図8は図6のC-C断面図である。

【0026】図6乃至図8に示すように、本研磨装置は研磨テーブル21に研磨液が流入する研磨液供給槽22を設け、該研磨液供給槽22の外周部に複数個(図では

5個)の長穴30を該研磨液供給槽22に連通して設け、更に研磨液供給槽22の下方に該長穴30に連通する研磨液排出槽31を設けている。また、研磨液供給槽22の底面中央には研磨液供給管26に連通する開口26aを設け、研磨液排出槽31の底面には研磨液排出管32、33に連通する開口32a、33aを設けている。研磨クロス10の研磨液供給口13及び研磨液流通孔23は図2と同様、研磨液供給槽22に連通している。なお、研磨液排出管32、33は開閉弁(図示せず)を通して工場廃液ライン若しくは図示しない研磨液再生ラインに通じている。

【0027】図6乃至図8に示す構成の研磨装置において、研磨を行う前には研磨液供給槽22及び研磨液排出槽31の両槽には純水が満たされている。研磨液供給槽22を研磨液で置換する場合は、最初上記研磨液排出管32、33の開閉弁を開け、研磨液供給槽22内の純水を工場廃液ラインとの高低差を利用して自重で排出する(例えば、3秒程度)。

【0028】次に、そのまま研磨液(スラリー)を所定流量(例えば、約500ml/min)で研磨液供給管26を通して研磨液供給槽22に供給する。研磨液は研磨液供給槽22を満たしながら、研磨液排出槽31に回り込む。両槽が研磨液で満たされた置換開始所定時間後(例えば約10秒後)、上記開閉弁を閉じる。更に所定時間(例えば約5秒程度)研磨液を供給すれば、研磨面に通じている多数の研磨液供給口13及び研磨液流通孔23も研磨液で置換され、研磨可能な状態となる。基板Wの研磨が終了し、研磨液供給槽22及び研磨液排出槽31内の研磨液を純水と置換する場合、上記手順を今度は純水を用いて行う。

【0029】上記のように長穴30を介して研磨液供給槽22に連通する研磨液排出槽31を設け、該研磨液排出槽31に連通する研磨液排出管32、33を設けたので、研磨開始前に研磨液供給槽22の純水を研磨液と置換する場合、研磨中に別の研磨液と置換する場合、研磨終了後に純粋と置換する場合、研磨液供給槽22の純水又は研磨液を研磨液排出槽31に集め研磨液排出管32、33を通して排出することにより、置換する研磨液や純水に研磨液供給槽22内の純水や研磨液を混合させることなく、速やかに置換できる。

【0030】

【発明の効果】以上説明したように各請求項に記載の発明によれば、下記のような優れた効果が得られる。

【0031】請求項1に記載の発明によれば、研磨テーブルの研磨面に開口する研磨液供給口を設け、研磨液供給手段により、研磨液供給口を通して基板の被研磨面と研磨テーブルの研磨面との間に研磨液を供給することにより、該被研磨面と研磨面の間に研磨液が浸透し均一な研磨液の膜が形成されるから、該被研磨面と研磨面の摩擦力が均一若しくは低減され、トップリングの振動が防



止されると同時に、該被研磨面と研磨面の間に研磨に必要な流量の研磨液のみが供給されることになり消費される研磨液流量を大幅に削減できる。

【0032】請求項2に記載の発明によれば、研磨面の凸部に設けた研磨液供給口を通して研磨面に研磨液を供給することにより、研磨作用に供された研磨液や研磨屑は速やかに凸部外周の凹部に流れ込むことになり、常に新鮮な研磨液で研磨が行われることになる。

【0033】請求項3に記載の発明によれば、研磨テーブルの研磨面と基板の被研磨面の相対運動により生じる圧力差で研磨液供給口から研磨液を供給するので、研磨に必要なだけの研磨液が供給されることになり、研磨液の消費量を大幅に削減できる。

【0034】請求項4に記載の発明によれば、溝に流れ込んだ研磨作用後の研磨液を排出することにより、研磨作用後の研磨液や削り屑が研磨テーブルの研磨面に流れ、基板の被研磨面の研磨に悪影響を及ぼすことがない。

【0035】請求項5に記載の発明によれば、研磨液供給槽に連通する研磨液排出槽を設け、該研磨液排出槽に連通する研磨液排出ラインを設けたので、研磨液供給槽内を別の研磨液又は純水に置換する場合、研磨液供給槽の研磨液又は純水を研磨液排出槽に集め研磨液排出ラインを通して排出することにより、置換する研磨液や純水に研磨液供給槽内の純水又は研磨液を混合させることなく、速やかに置換できる。

【図面の簡単な説明】

【図1】本発明に係る研磨装置の研磨クロスを示す図で、図1(a)は平面図、図1(b)は一部拡大図、図1(c)は一部断面図である。

【図2】本発明に係る研磨装置の概略構成を示す断面図である。

\*【図3】本発明に係る研磨装置で基板を研磨した場合の実験結果を示す図である。

【図4】本発明に係る研磨装置の研磨クロスを示す平面図である。

【図5】本発明に係る研磨装置の研磨クロスを示す一部平面図である。

【図6】本発明に係る研磨装置の概略構成を示す断面図である。

【図7】図6のB-B断面図である。

10 【図8】図6のC-C断面図である。

【符号の説明】

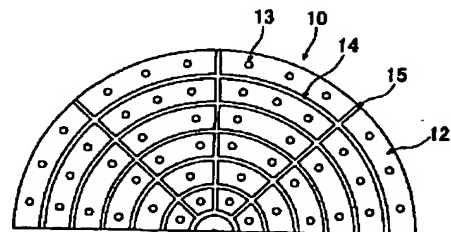
- 10 研磨クロス
- 11 溝
- 12 シマ
- 13 研磨液供給口
- 14 溝
- 15 溝
- 20 研磨装置
- 21 研磨テーブル
- 22 研磨液供給槽
- 23 研磨液流通孔
- 24 純水供給管
- 25 スラリー供給管
- 26 研磨液供給管
- 27 偏心回転軸機構
- 28 偏心回転軸機構
- 29 トップリング
- 30 長穴
- 31 研磨液排出槽
- 32 研磨液排出管
- 33 研磨液排出管
- \* W 基板

【図3】

スラリー流量 (ml/min)	基板の径方向を所定のピッチで測定			基板の周方向を所定のピッチで測定			凹凸発生
	P/R(nm/min)	Unit(1σ)(%)	Unit(M-m)	P/R(nm/min)	Unit(1σ)(%)	Unit(M-m)	
40(ml/min)	55.5	8.0	23.0	47.3	22.0	31.7	微
50(ml/min)	56.0	9.9	25.3	48.1	24.1	31.8	なし
75(ml/min)	55.8	10.3	26.2	48.4	23.5	32.5	なし
100(ml/min)	57.4	8.7	24.9	47.8	22.9	31.5	なし

本発明に係る研磨装置で基板を研磨した場合の実験結果

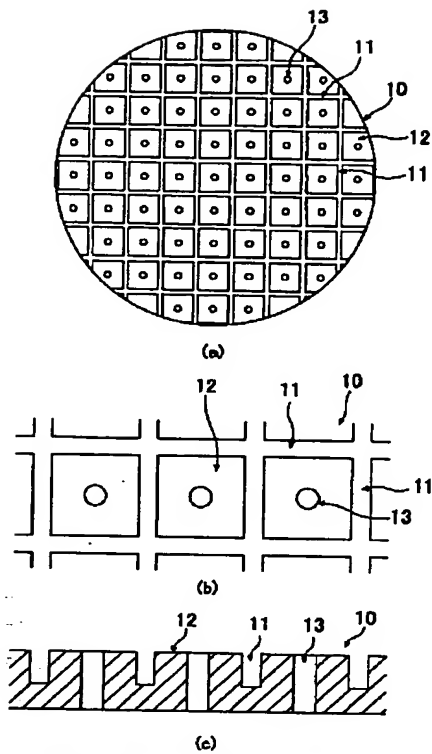
【図5】



- 10: 研磨クロス
- 12: シマ
- 13: 研磨液供給口
- 14: 溝
- 15: 溝

本発明に係る研磨装置の研磨クロスを示す一部平面図

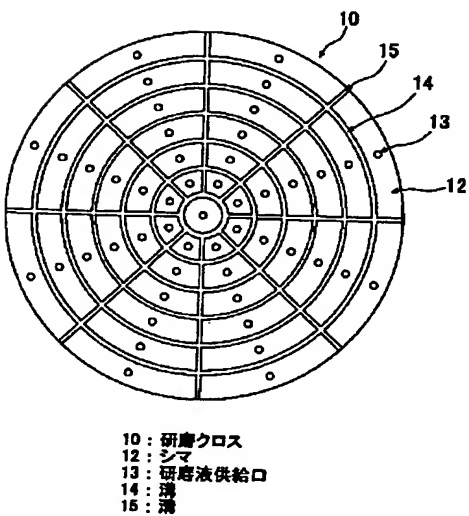
【図1】



10: 研磨クロス  
11: 溝  
12: シマ  
13: 研磨液供給口

本発明に係る研磨装置の研磨クロス

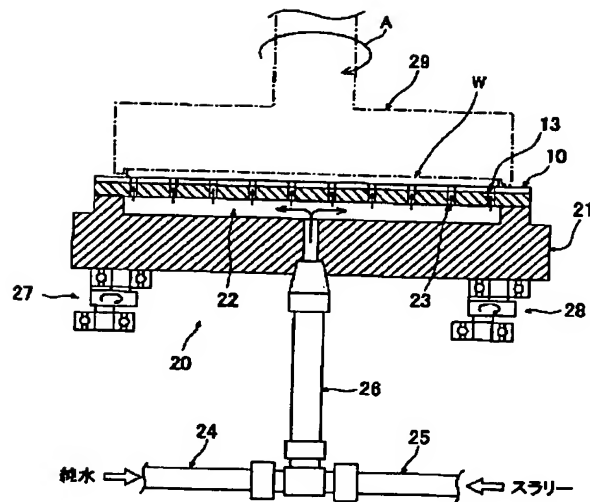
【図4】



10: 研磨クロス  
12: シマ  
13: 研磨液供給口  
14: 溝  
15: 溝

本発明に係る研磨装置の研磨クロスを示す平面図

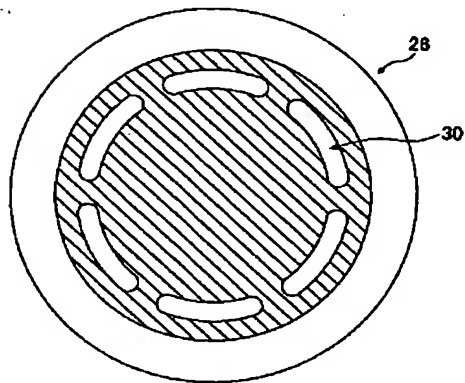
【図2】



10: 研磨クロス  
13: 研磨液供給口  
20: 研磨装置  
21: 研磨テーブル  
22: 研磨液供給槽  
23: 研磨液流出口  
24: 純水供給管  
25: スラリー供給管  
26: 研磨液供給管  
27: 偏心回転軸機構  
28: 偏心回転軸機構  
29: トップリング  
W: 基板

本発明に係る研磨装置の概略構成を示す断面図

【図7】



26: 研磨液供給管  
30: 長穴

図6のB-B断面図



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